

Colloidal Properties of Crude Oils and Heavy Petroleum Fractions Studied by Dynamic Light Scattering

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The results of some experimental investigations of colloidal properties of crude oils and heavy petroleum fractions are presented. Heavy fractions of crude oil, e. g. asphaltenes, play a significant role in the colloidal structure formation. Asphaltenes determine the viscosity of crude oils and have a tendency to flocculate and precipitate. Asphaltene precipitation may cause troubles in oil recovery and refinery. Investigating the fundamentals of colloid and micelle formation in petroleum fluids and their possible universal behavior is challenging for both science and engineering. Dynamic light scattering has been used for measurements of colloid particle sizes to monitor the aggregation kinetics in real time. An original optical scheme has been used to perform dynamic light-scattering measurements in opaque petroleum systems. The technique makes it possible to observe colloid particles in various original oils. Moreover, measurement of the diffusion of suspended Brownian particles of known size enables one to obtain the shear viscosity of crude oils. The nature of the colloid particles in crude oils as well as their aggregation have been investigated by adding *n*-heptane as a precipitant and toluene as a good solvent. The aggregation phenomena have also been studied for asphaltenes dissolved in toluene-*n*-heptane mixtures of various ratios. The results obtained have proved the existence of a mesoscopic structure in crude oils and demonstrate universal behavior of asphaltene aggregation in hydrocarbon solutions.

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